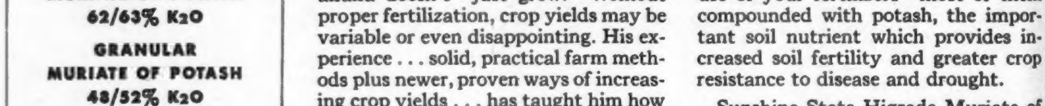
The American FERTILIZER



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AMERICAN FERTILIZER

" That man is a benefactor to his race who makes two blades of grass to grow where but one grew before."

Vol. 101 DECEMBER 30, 1944 No. 13

Greenhouse and Field Tests Comparing Colloidal Phosphate, Phosphate Rock and Superphosphate as Sources of Phosphorus for Various Crop Plants

By BAILEY E. BROWN AND KENNETH D. JACOB[1]

DURING the past 15 years much has been written about colloidal phosphate, sometimes called "waste-pond phosphate."[2] The Association of Official Agricultural Chemists has defined this material as "A very finely divided low-analysis by-product from mining Florida rock phosphate by a hydraulic process in which the colloidal material settles at points in artificial ponds and basins farthest from the washer, and is later removed after the natural evaporation of the water." Officially, the material has been designated as "soft phosphate with colloidal clay," but it is generally referred to as "colloidal phosphate."

Colloidal phosphate has been proposed and strongly advocated by some for fertilizer use. Claims have been made that because of the extreme fineness of the material its phosphorus will be rendered more quickly available than otherwise and that it possesses a desirable content of certain so-called minor elements essential to plant growth. Owing to the insolubility of the phosphorus in colloidal phosphate as measured by chemical methods, it cannot be used in commercial fertilizers as a source of phosphorus. This limits its use to direct application. It is felt by some that under certain soil conditions—usually when relatively high acidity prevails, when an ample supply of actively decaying organic matter is present in the soil, and for certain long-season crops, including pastures—the use of colloidal phosphate may be justified.

In the present studies, both greenhouse and field, colloidal phosphate, finely ground phosphate rock (Tennessee brown), and ordinary superphosphate were compared as sources of phosphorus for various crop plants. Before reporting the results obtained, a review is given of what other investigators have done to evaluate colloidal phosphate as a source of phosphorus for crop production.

Review of Literature

The earliest report dealing with colloidal phosphate was made by the Iowa Station *(20)*[3] on preliminary results of pot-culture tests with wheat on Tama silt loam. On page 50 of the Annual Report of the Station for the year ending June 30, 1929, the following statement is made:

"The relative values of colloidal phosphate and other phosphate fertilizers were determined in pot-culture tests with wheat on Tama silt loam in the greenhouse. Significant differ-

[1]Respectively, senior biochemist, Division of Fruit and Vegetable Crops and Diseases, and principal chemist, Division of Soil and Fertilizer Investigations, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture.

[2]The material has been offered for sale under a number of names, such as Collophos, Mineral Colloids, Min-Coll, Phosphate Colloids, Cal-Phos, PhosCaloids, Vitaloid Phosphate, Lonfosco, Colimephos, Sea-Coll and Kellphos.

[3]Figures in parentheses refer to "Literature Cited," at close of paper.

ences were obtained in the growth of the wheat with colloidal phosphate, superphosphate, and rock phosphate in favor of the colloidal phosphate when it was applied at the rate of 1000 pounds per acre, rock phosphate at 1000 pounds per acre, and superphosphate at the rate of 150 pounds per acre."

Stallings (*25*) reported that colloidal phosphate gave as good results as superphosphate when applied at twice the rate of the latter to English peas in Florida.

Bartlett (*2*), reporting on the analysis of colloidal phosphate and on field experiments with it on potatoes in Maine, stated that results of the latter were inconclusive as based on unofficial field tests.

Chucka and Lovejoy (*12*), of the Maine Agricultural Experiment Station, made the following statement concerning the use of phosphate rock and colloidal phosphate as sources of phosphorus in potato fertilizers:

"The substitution of rock phosphate or colloidal phosphate for superphosphate in potato fertilizers resulted in lowering the yield 20 to 30 barrels per acre on one farm and 54 to 58 barrels per acre on another farm. These results strongly indicate the necessity of having a soluble source of phosphorus in potato fertilizers."

Brown and Hawkins (*10*), in a comparison of colloidal phosphate, phosphate rock, and ordinary superphosphate as sources of phosphorus for potato fertilizers in Aroostook County, Maine, stated:

"Colloidal phosphate in these field studies on potatoes was but little more effective than finely ground rock phosphate. Superphosphate proved to be a more efficient source of phosphorus than either of the less available phosphates, in that its use resulted in larger yields, probably induced by thriftier vine development. The results of this study suggest in some measure the futility of attempting to grow potatoes, certainly under Aroostook County conditions, without phosphorus in the fertilizer, or without employing an available phosphorus source, such as superphosphate, treble superphosphate or ammonium phosphate, in the potato fertilizer."

Bledsoe (*9*) reported results on a phosphate-source study with cotton in which superphosphate was compared with Florida soft phosphate, presumably colloidal phosphate, and other mineral phosphates, which showed that superphosphate for a 5-year period (1921–25) was superior to any of the less available phosphates. Of the different phosphates compared, the soft phosphate produced the lowest average yield of seed cotton per acre.

At the Massachusetts Agricultural Experiment Station, Haskins (*18*) carried on vegetation pot experiments to determine the availability or crop-producing value of certain phosphatic materials, including colloidal phosphate. Dwarf Essex rape was the crop grown. The results for the raw mineral products—colloidal phosphate and finely ground phosphate rock—did not show, in Series I where the minimum ration of phosphoric acid was used (about 200 pounds of phosphoric acid per acre), any average gain in dry-matter yield over the no-phosphate pots. In Series II, with optimum phosphoric acid applied (400 pounds per acre), the two raw mineral phosphates, colloidal phosphate and finely-ground phosphate rock, showed an average availability of about 18 based on dry-matter yield, and about 37 based on recovery of phosphoric acid, as compared with superphosphate at 100. In Series III, where double the optimum amount of phosphoric acid was used, colloidal phosphate was rated for availability at 63 and 61, and phosphate rock at 28 and 45, based, respectively, on dry-matter yield and on phosphoric acid recovery, as compared with superphosphate at 100.

Jacob *et al.* (*21*) conducted greenhouse tests on phosphorus-deficient soils to determine the relative effectiveness of various phosphates, including colloidal phosphate, Tennessee brown-rock phosphate, and Florida pebble phosphate, as sources of phosphorus for cabbage (Alabama Station); for millet (U. S. Department of Agriculture and West Virginia Station); and for Sudan grass (Arkansas and West Virginia Stations). Summing up the data obtained, they stated:

"Compared to 100 as the increase in dry weight of plants receiving superphosphate, the average efficiencies of colloidal phosphate, Tennessee brown-rock, 100-mesh Florida pebble, and 200-mesh Florida pebble were 27, 33, 39, and 67, respectively. Based on the phosphorus content of the plants, the relative efficiencies were 23, 19, 27, and 67, respectively."

Fraps (*13*), from pot tests with corn and sorghum, stated that soft phosphate with colloidal clay (colloidal phosphate) and finely ground phosphate rock both contain phosphoric acid that has a much lower availability to plants than the phosphoric acid of superphosphate, especially on neutral or basic soils, such as generally prevail in Texas. He found that the availability of the phosphoric acid in colloidal phosphate in 7 pot experiments averaged about 40 compared with the phosphoric acid of superphosphate as 100. Fraps further stated:

"On some acid soils, the availability of the phosphoric acid of both soft phosphate with colloidal clay and finely ground rock phosphate is equal to that of superphosphate, but on other acid soils its availability is decidedly less than that of superphosphate."

Fraps and Sterges (*14*) made studies on the effect of phosphates on nitrifying capacity of soils which led these investigators to state:

"The average order of effectiveness of phosphate (averages of 14 soils) to promote nitrification, beginning with the most effective, is as follows: monopotassium phosphate, 20 per cent superphosphate, dipotassium phosphate, monocalcium phosphate, tricalcium phosphate, dicalcium phosphate, disodium phosphate, rock phosphates, soft phosphate with colloidal clay. The results are in the order one could expect from the knowledge of the availability of the phosphoric acid in the phosphates."

C. B. Williams, Agronomy Department, North Carolina College of Agriculture, in a letter[4] dated February 21, 1944, stated:

"As a result of 7 years' experiments on Cecil sandy loam on the Central Experiment Station Farm here at the College, we found using 800 pounds per acre of a 4–10–4 fertilizer on cotton, that colloidal phosphate gave us 865 pounds of seed cotton per acre. When we used superphosphate as the source of phosphoric acid in these experiments our average yield was 934 pounds of seed cotton per acre."

The North Carolina Agricultural Experiment Station issued statements in Annual Reports (1932, 1933, and 1934) regarding the results of experimental tests with colloidal phosphate as a source of phosphorus for different crops as follows:

In the 1932 Report: A comparison of colloidal phosphate and basic slag with superphosphate as sources of phosphoric acid for the growth of cotton on Cecil sandy loam showed that, when equal quantities of phosphoric acid were employed, the superphosphate produced 7 per cent more cotton than either of the other sources for the past 3 years.

In the 1933 Report: A comparison of phosphate rock, superphosphate, soft phosphate, (presumably colloidal phosphate) and basic slag as sources of phosphorus is a rotation of corn, wheat, and soybeans on Toxaway loam soil furnished yield data showing that the limed series produced larger yields than the series that did not receive lime and that superphosphate was the most efficient source of phosphoric acid used in these trials.

[4]To Bailey E. Brown.

In the 1934 Report: A comparison to determine the relative effectiveness of superphosphate, colloidal phosphate, and basic slag as carriers of phosphorus in the production of cotton showed that when the same amounts of phosphorus were applied from each of these three sources superphosphate produced more cotton than did either of the other two.

K. T. Holley (*19*) of the Georgia Agricultural Experiment Station had this to say about colloidal phosphate:

"Preliminary results of phosphate tests at the Georgia Experiment Station indicate that soft phosphates with colloidal clay have little, if any, more value than phosphate rock as ordinarily marketed."

He further stated:

"In these greenhouse tests at this Station with sorghum as the crop on Appling sandy loam soil or washed sand, this material failed to show any appreciable advantage over no-phosphate additions, though the plants made a good response to applications of superphosphate."

Concerning the relative effectiveness of colloidal phosphate and superphosphate on cotton, the Georgia Experiment Station (16) reported as follows:

"An experiment where colloidal phosphate was substituted for superphosphate in a mixed fertilizer for cotton had been carried on for 4 years on Decatur clay loam near Cedartown. The average results to date are as follows:

COLLOIDAL PHOSPHATE FOR COTTON

Phosphate per Acre	Seed Cotton per Acre Increase Over No Phosphorus 1935 Lb.	1936 Lb.	1937 Lb.	1938 Lb.	Av. 4 years Lb.
Superphosphate—200 pounds......	15	74	109	137	84
Colloidal phosphate—200 pouns.....	−14	−12	53	40	17

"It will be noted at once that not until three crops had been grown did colloidal phosphate give any benefit whatever, while superphosphate has given highly beneficial results after the first year."

Gross (*17*) of the Mississippi Station, in a general compilation of cotton fertilizer trials, presented results of a phosphorus-source experiment which showed colloidal phosphate was inferior to superphosphate, the latter producing an average yield for a 5-year period (1929–34) of 964 pounds of crop harvested as against 856 pounds from colloidal phosphate as the phosphorus source.

Blaser (*4*) in connection with pasture studies reported that phosphate rock and colloidal phosphate can be partially or wholly substituted for superphosphate on some soil types and under certain soil conditions in Florida.

Karraker *et al.* (*22*), of the Kentucky Station, conducted greenhouse studies comparing colloidal phosphate with several other phosphates as sources of phosphorus for nine kinds of crop plants. They stated:

"Superphosphate, triple superphosphate, dicalcium phosphate, calcium metaphosphate, and fused rock phosphate were practically equally available in the greenhouse tests. In these tests tricalcium phosphate was appreciably less available than these others, and rock and colloidal phosphate were very much less available."

Blaser (*5*), referring to the use of phosphate rock and colloidal phosphate for lespedeza in Florida, pointed out that:

"Rock and colloidal phosphates applied at 3000 pounds per acre with 36 pounds K_2O produced good lespedeza growth. Tests show that rock or colloidal phosphate applied at the rate of 1,500 pounds per acre with one-half ton of lime and 36 pounds of K_2O per acre also produces good lespedeza growth.

Wyche (*29*) of the Texas Agricultural Experiment Station, reporting on the results of fertilizer studies on rice, stated:

"Bone meal and regular and granular superphosphate were of approximately equal value as sources of phosphoric acid. Soft phosphate with colloidal clay was an inferior source of phosphoric acid on the Station soils."

Blaser, Volk, and Smith (*8*) of the Florida Station have reported results of fertilizer studies, obtained with clover pastures which were given different phosphate and other treatments. Their results indicate that neither rock phosphate nor colloidal phosphate was as efficient as superphosphate as a source of phosphorus.

White-Stevens (*28*) reported from results obtained on Long Island in a comparison of several phosphates—superphosphate, colloidal phosphate, Ammo-phos, Nitro-phoska, potassium metaphosphate, and monocalcium phosphate—that colloidal phosphate performed just as efficiently as a source of phosphorus for potatoes as did superphosphate under certain conditions. However, his recorded data show that in three out of four experiments the superphosphate was the superior source when applied in equal bands with the N and K materials.

Volk (*26*) of the Alabama Station conducted greenhouse and field tests to determine the relative value of waste-pond phosphate (colloidal phosphate) as compared with superphosphate and phosphate rock. The results were summarized as follows:

"1. The results from greenhouse pot tests and field experiments indicate that superphosphate is far superior to waste-pond or rock phosphate as a source of phosphorus for the growth of cotton, sorghum, hairy vetch, and Austrian peas.

"2. Neither rock nor waste-pond phosphate increased the growth of vetch or sorghum significantly on Sumter clay (a calcareous soil), while superphosphate greatly increased the growth of these plants on this soil.

"3. Waste-pond phosphate and rock phosphate appear to be equal in their ability to supply phosphorus for plant growth.

"4. As the rate of application of waste-pond or rock phosphate was increased from 48 to 384 pounds of P_2O_5 per acre, there was very little, if any, increase in the crop yields."

Volk (*27*) reporting the results of greenhouse pot-culture studies at the Alabama Station to determine the availability of rock and other phosphate fertilizers as influenced by lime and forms of nitrogen fertilizer, stated:

"Superphosphate and calcium metaphosphate were the best phosphate fertilizers for oats and sorghum, fused rock phosphate was almost as good as the former two, and ordinary rock and waste-pond phosphates were decidedly inferior."

Volk, in connection with the foregoing investigations, further stated:

"Even though the yields of sorghum and oats were greatly increased by using acid-forming nitrogenous fertilizers with the more insoluble phosphates, the yields were still much lower than those obtained with superphosphate."

Blaser and Stokes (*7*) of the Florida Station, conducted field experiments on eight soil types during 1938 to study the effect of superphosphate, basic slag, phosphate rock, and colloidal phosphate, plus various fertilizer mixtures, on clover growth and on the chemical composition of carpet grass. The writers stated:

"The phosphorus from all four sources increased the phosphorus content greatly over that of the unfertilized grass. The calcium content of carpet grass was also increased by all of the phosphate from different sources on all five soils, with the exception of the colloidal phosphate treatment on one soil. Carpet grass was slightly higher in calcium when treated with rock phosphate than with colloidal phosphate.

(Continued on page 22)

U. S. Department of Agriculture and Farmers Organizations

Claude E. Wickard, Secretary of Agriculture, speaking at the annual meeting of Land-Grant Colleges, defined the attitude of the federal department toward farm organizations. He said:

"As you all know the U. S. Department of Agriculture believes in farm organizations, encourages them, and works with them. But the department does not work for them. Years ago it found out that helped neither the organization nor the department.

"I recall back in my home community, how my friends and I were sometimes critical because we could not get more active support from the Extension Service for the cooperative organizations which we were trying to build. I also recall my disappointment after I had gone to Washington, that the Extension Service sometimes did not take a more active part in some of the national farm programs. But after some years of experience and responsibility at about all levels of agricultural activity, I have come to see quite clearly that, it is impossible to have an organization do a good job in the educational field while also having to do administrative work, sales work, or promotion work for any other interest or organization."

Summarizing at the end of his address and covering the entire activities of Land-Grant Colleges, he said:

"First of all progress in agriculture and home making depends upon research and education. Second, the Land-Grant Colleges are the best fitted to do this work. Third, they can fully discharge their obligations in this only when their research is unfettered and they are free to present all the facts to all the people at all times."

Highlights of Cotton Conference

Highlights of the recent week-long cotton conference held in Washington, D. C., have been summarized as follows:

Continuation of price support and loan programs along with marketing quotas to adjust production up or down according to market demands; allocation of domestic consumption to farmers with price support and loans on cotton produced within their allotments. All extra cotton would be for export at world market prices; subsidies to cotton growers to make up the difference between the market and parity prices. Although expensive, this plan was suggested for a period until cotton is self-supporting; subsidization of imports after the war by means of customs duties collected upon imports. Receipts of this tax would be divided among exporters so that they could meet world prices; reduction of cotton costs by mechanization; reduction of tariff and other trade barriers; an international cotton agreement similar to the international wheat agreement; continue and expand soil conservation.

International Minerals Awards Service Pins

Service pins are being awarded by the International Minerals and Chemical Corporation to all employees having five or more years with the organization. On Dec. 21st twenty-seven employees of the Chicago office were awarded service pins at a dinner. Similar meetings were scheduled for other cities where the corporation has offices, mines and plants. Approximately 4,500 persons are in the employ of the Company. According to an announcement by President Louis Ware, 677 are entitled to service pin awards.

N. F. A. Notes

Dr. Charles J. Brand, Executive Secretary-Treasurer of the National Fertilizer Association, was recently elected honorary member of the American Soybean Association.

H. R. Smalley, Agronomist of the National Fertilizer Association, has rounded out 25 years service for the Association. His work has been of a high order, for which he is held in high esteem not only by the industry, but by agricultural workers in state and federal service and by farmers.

W. S. Ritnour of the staff of the National Fertilizer Association, and Miss Chloe Margaret Ivey of Valdosta, Ga., were married on December 28th. Mrs. Ritnour is a niece of President A. Lynn Ivey of the Virginia Carolina Chemical Company. Mr. Ritnour is assistant to the treasurer of the Association.

New Procedure in Nitrogen Purchase

Changes made by the War Production Board bring nitrogen compounds under the General Allocation Order M–300, schedules 79 and 80, and revokes Order M–62, M–163, M–164 and M–165.

Deliveries already authorized under M–62, M–163, M–164 and M–165 may be made at any time up to February 10, 1945, and nitrogen compounds shipped on or before Feb. 10, 1945, by any producer or importer may be received, used or redelivered by any person without application or certification under this schedule, but subject to any conditions on which he was allocated the nitrogen compounds.

The *allocation period* is based on the calendar month. No exemptions are made on small orders of fertilizer nitrogen.

Procedure: A fertilizer manufacturer desiring to purchase any nitrogen compound for his own use in making mixed fertilizers or for resale for use in direct applications, places his order with the supplier along with a certificate of the proposed ultimate use of the material ordered. It will not be necessary to give the customer's name, except when the customer is another fertilizer manufacturer. The fertilizer manufacturer must make use of the material as set forth in the certificate.

Allocation does not extend to individual customers of the manufacturer and such customers do not have to file statements of use, except in case the customer is another fertilizer manufacturer.

Suppliers seeking authorization to use or deliver any nitrogen compound must make an application on Form WPB–2947 not later than the 10th day of the month preceding the month of proposed delivery. This form calls for the name and address of each customer, the ultimate use for which the material is ordered, and quantity ordered for each use.

Included among the WPB authorizations is one permitting sulphate of ammonia producers to sell to their ability to produce and deliver. Previous limitations based on estimated production are discontinued.

Restrictions on uses have been authorized by WPB whereby sulphate of ammonia is limited to use in mixed goods, while the agricultural use of nitrate of soda, Cal-Nitro and A–N–L is restricted to direct applications. These restrictions are applicable to the territory east of the Rocky Mountains. West of the Rocky Mountains they do not apply.

Synthetic Ammonia purchase procedure is similar to that for nitrogen compounds, except that suppliers must file application for an allocation by the 20th of the month preceding the month of proposed delivery.

Prompt Acceptance of nitrogen materials is advised by the War Food Administration. Under the new procedure WFA says a failure to accept deliveries in an orderly manner may seriously affect the total quantities available to the fertilizer manufacturer.

October Sulphate of Ammonia

Figures of the U. S. Bureau of Mines show little change in the production of by-product sulphate of ammonia during October. An increase of 6.1 per cent over September is partly accounted for by the extra working day in October. Shipments continue to about equal production leaving stocks on hand practically unchanged, about a month's output remaining in storage at producing points at the end of October.

	Sulphate of Ammonia	Ammonia Liquor
Production	Tons	Tons NH_3
October, 1944	69,474	2,716
September, 1944	65,484	2,631
October, 1943	65,204	2,916
January-October, 1944	678,573	26,575
January-October, 1943	634,418	28,457
Sales		
October, 1944	71,443	2,532
September, 1944	67,629	2,465
October, 1943	58,401	3,092
Stocks on hand		
October 31, 1944	77,046	678
September 30, 1944	77,341	637
October 31, 1943	44,957	983
September 30, 1943	38,192	1,015

Army Trained Bug Killers Have Jobs in Prospect

Thousands of men trained in the Army to kill disease-carrying insects will be available for putting new and effective methods into effect in this country. Elimination of the mosquito and other insects known to carry diseases is considered a happy prospect of jobs for thousands of returned soldiers who have learned how in the jungles. New insecticides that have proven quite effective will be available for home use after the war.

IT MAY BE

By SAMUEL L. VEITCH

Transportation

The year 1945 will be the most trying in the entire history of transportation in this country, according to Colonel J. Monros Johnson, Director of the Office of Defense Transportation.

Civilian Goods

Production of Civilian Goods is restricted by the War Production Board to levels allowed for the Fourth Quarter of 1944. The reason is apparent that the war in Europe did not end as scheduled.

Fertilizer Freight Rates

Increase in freight rates on fertilizer promulgated by the Interstate Commerce has been suspended until January 1, 1946. This followed a reopening of the case in which considerable new evidence was introduced by both shippers and railroads.

Executive Secretary Charles J. Brand presented testimony for the National Fertilizer Association with John T. Mooney taking the oral argument.

Attention was drawn to the narrow margin on which the fertilizer business is being conducted, and to the inevitable decrease in consumption cost imposed by increased freight rates.

Sulphate of Ammonia Allocations

For the territory east of the Rocky Mountains, increased amounts of sulphate of ammonia are authorized by the War Production Board. This increase is equivalent to one month's allotment or one-twelfth of the total allotment. The minimum is one car to each fertilizer manufacturer. The increase may all be taken in January, or if preferred, in equal amounts during January, February, and March. But, there is an "if": the increased supply is conditioned upon the production of sulphate of ammonia being maintained at present levels. Failure to take at least one-third of the additional tonnage during each of the three months designated, will not entitle buyer to take this added tonnage in subsequent months.

Washington

It may be, Washington is digging in for a two-front war lasting well into 1945. The reconversion talk has been put] over in the long-range planning division with a tag marked "Don't Open Until 1946." But—keep in mind official Washington thinking seldom is on a "straight line" for any great length of time.

Flaxseed Subsidy

The crop insurance bill covering cotton, wheat, and flaxseed contained a rider making $30,000,000 available as incentive payments to increase the production of flaxseed against the needs for more linseed oil, particularly in the manufacture of paints.

Fertilizer

The fertilizer situation is steadily getting less promising. The supply of superphosphate will be 10 to 15 per cent below last year; nitrate 10 per cent less.

Lend-Lease

Lend-lease deliveries of agricultural products last year amounted to 7,272,000,000 pounds compared with 11,488,000,000 pounds in 1943. Shipments comprised 37 per cent meat and meat products, 17 per cent each dairy and cereal products.

Selling to Farmers

There is great likelihood of OPA planning a "retail-absorption formula" designed to protect farmers from paying the full amount of future price increases granted manufacturers by OPA. It may be a squeeze all along the line, including retailers, middlemen and manufacturers.

Allocations of Synthetic Ammonia

Less than half the synthetic ammonia requested by the fertilizer industry in December was allocated by the War Production Board. January allocations, it is stated, will be about the same as for December.

Sulphate of Ammonia

Production of sulphate of ammonia, it is reported, continues slightly under previous estimates, but with stocks accumulated by producers it has been possible to make allocations in line with requests. In fact, WPB has seen fit to permit an increase of one-twelfth to fertilizer manufacturers east of the Rocky Mountains, for delivery during January, February and March.

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Vol. 101 DECEMBER 30, 1944 No. 13

Principal Articles in This Issue

Drafting Labor Away from the Farm

Nothing is more essential than food, and no industry is more essential, war or peace, than agriculture. If agriculture could spare farm boys for the armed services, there could be no reasonable objection to drafting them. But agriculture is already undermanned. The fact that farmers have been able to increase the output of their farms should not be taken as evidence that agriculture can spare some of its labor. The increase has been achieved by heroic efforts of the old and under-age on the farm, by recruiting boys from the cities, and by working long hours without the incentive of "time and a half" pay for overtime.

Nearly a million and a half farm boys are in the armed forces in spite of the deferment allowed them. Still more have left the farm to work in war plants, taking their families with them. As a result of enlistments in the armed forces and migrating to war industries, federal estimates place the reduction of the rural population of the United States at more than 4,000,000.

Yet farmers are called upon by the War Food Administration to maintain their back-breaking records of food and feed production and in some particulars to grow still more.

It is to be feared that farmers will feel that further drafting of farm labor for war services reveals a lack of appreciation in Washington of the supreme efforts they have been making, and become discouraged.

Not only manpower but horsepower is off. Federal statistics reveal that in the past thirty years, the number of horses in this country has gone down from 21 million to a little over 9 million. In less than 20 years, the number of mules has gone down from about 6 million to a little over 3½ million.

Evidently horse-saving machinery has brought this about, which also accounts for the increase in crop production in spite of reduction in man and horsepower on the farm. Yet labor-saving machinery is not to be looked to as an offset to further loss of manpower on the farm. Not enough labor-saving machinery is available to offset farm labor already lost, and if there were, not enough trained men are left on the farms to operate it.

It appears plainly evident that agriculture is undermanned and that it cannot afford further manpower loss, without a reduction of food production, food for the armed forces and food for hungry peoples all over the world.

Charles J. Brand To Retire as N. F. A. Secretary

An announcement by the National Fertilizer Association that its executive secretary and treasurer, Charles J. Brand, has requested retirement April 1, 1945, was learned with much regret by the industry. The Board of Directors, it is announced, has acceded to Mr. Brand's request and has voted an annual retirement payment.

In asking for retirement, Mr. Brand has stated that he has reached an age when it is customary to give way to younger men. The date of April 1, 1945, was set by him as a time when a change would be most easily effected and far enough ahead to allow the Board of Directors to look over the field and select a new executive officer.

The National Fertilizer Association is doubtless much concerned over the announcement of Mr. Brand's retirement. For many years he has been a dominant figure in the industry. His wide knowledge and keen interpretation of trends relating to the industry have been relied upon for guidance. Great progress has been made by the industry during his tenure of office. His activity has not abated with the years. Members of the industry had come to think of Mr. Brand as a fixture and overlooked the fact that he was not ageless.

Unquestionably Mr. Brand holds a high position in the esteem of fertilizer manufacturers everywhere. His services have been characterized by sincerity of the scientist, maintained on a high level, and sustained by facts carefully ascertained. As a consequence he has held the respect and confidence not only of the industry but by agricultural leaders of this nation.

Federal Crop Loans

Cotton

Non-recourse loans at 92½ per cent of the parity price as of August 1, 1945, will be made available to farmers on American upland cotton produced in 1945 and stored on farms or in warehouses. The loans will be based on middling ⅞-inch cotton. Premiums or discounts are to be granted on other qualities. Loans on 1945 crop will mature July 31, 1946.

Peanuts

Peanuts produced in 1945 will be supported at base prices to farmers of $160 per ton for Spanish, Virginia and Valencia types, and $145 per ton for runner types. These base prices are for peanuts having a sound and mature kernel.

The War Food Administration, which will be the only authorized buyer of the 1945 crop, will contract with shellers, and farmers at not less than the support prices, and will make peanuts available for processing and distribution at ceiling prices. Loans will also be made by the War Food Administration through cooperative associations.

Sweet Potatoes

Non-recourse loans will be made available to farmers and cooperative associations on cured sweet potatoes produced in 1945, packed in standard crates, baskets or hampers, and assembled in lots of 1,000 bushels or more in approved warehouses. Loans will also be made to dealers who pay farmers not less than the equivalent of support prices. Loans will be made at 90 per cent of the parity price as of November 1, 1945, of not less than $1.50, U. S. No. 1 grade, from Nov. 15th to Dec. 31st; $1.65 per bushel in January, and $1.75 in February, 1946. Loans on U. S. No. 2 grade containing not less than 75 per cent No. 1 quality will be 15 cents less per bushel than No. 1 grade from Nov. 15, 1945, to Feb. 25, 1946. The loans will mature on April 15, 1946, or earlier on demand.

The support loans will be supplemented, if necessary, by purchases of uncured potatoes in carload lots for relief purposes and by other surplus diversions.

Ritz Honored by Baltimore Industry

John P. F. Ritz, president of the Miller Fertilizer Co. until the firm was consolidated with the Davison Chemical Corporation, was honored with a dinner on December 15th by representatives of the Baltimore fertilizer industry. The occasion was a recognition of the services of Mr. Ritz in various federal agencies, lately with the War Food Administration.

Rice production in the United States has been given a great impetus by the war. In 1943 the U. S. acreage in rice was 52 per cent greater than the average of the preceding ten years and the production 48 per cent greater. Louisiana and Arkansas are the leading producers.

Hunger Signs in Crops

When plants do not grow well, the trouble may be attributed to deficiencies of nitrogen, phosphorus, or potassium in the soil. Other elements, such as magnesium, iron, boron or calcium, may have comparable effects, but symptoms of their shortage are not as apparent as with the others, says Dr. Luther G. Jones, acting head of Texas A. and M's Agronomy Department.

Generally, Dr. Jones says, the limitation can be supplied by manures, chemical elements or fertilizers. But he believes that in each instance careful observation of the growing plant first is necessary to determine what elements are lacking. Under field conditions the most common deficiency probably is nitrogen. Its lack first becomes apparent in the decline of green color accompanied by a slowing down or stoppage of growth. Lack of water may have a similar effect but it is not pronounced in the early stages as is nitrogen starvation.

Insufficient root growth, failure to seed or flower properly, and inability of the bud leaves to retain a normal appearance usually are associated with lack of phosphorus. Other deficiency results include failure of a plant to develop the proper amount of protein, and with legumes the inability to produce the proper amount of nitrogen fixation in the nodules. As this condition is more difficult to determine by the usual observation methods, chemical aids are needed for detection.

It is difficult to describe definite symptoms of phosphorus deficiency in corn, Dr. Jones says, except in a retarded rate of growth, slow maturity and lack of root development, especially during the pollination stage. Deficiency in small grains is apparent in a tendency to lodge. They require large quantities for the production of seed and are dependent upon available phosphates for stooling properly.

Potassium deficiency is observed most often in the mottling of the lower leaves of tomatoes and other leafy plants. The characteristic mottling may be associated with the loss of green color and then is called chlorosis. A liberal supply of potassium enables the plant to withstand or ward off leaf spots caused by bacteria and permits the formation of a liberal amount of starch in small grains.

Texas Gulf Sulphur Promotes Wemple

Holland R. Wemple has been made vice-president of Texas Sulphur Company, according to an announcement made by President Walter H. Aldridge, of the company. Mr. Wemple has many friends in the fertilizer industry who are delighted with his promotion.

Mechanized Cotton Farming

A large-scale demonstration of mechanized cotton farming has been carried on last year on a delta farm near Clarkesville, Miss. The land was prepared by tractor, planted with machine, cultivated with tractor-drawn plows, and the crop was harvested with a mechanical cotton picker after plants had been defoliated by a chemical applied by a mechanical sprayer. Labor cost, it is stated, was very low and cost of production quite below the usual figure.

Throughout the world it takes two families to produce enough food for themselves and an additional family. In the United States one farm family produces enough food and other products for itself and four other families.

FERTILIZER MATERIALS MARKET

NEW YORK

Nitrogen Not Removed from Allocation. Materials Moving Steadily. Tight Situation Continues to Prevail in Superphosphate. Potash and Phosphate Rock Seem Ample for Requirements.

Exclusive Correspondence to "The American Fertilizer"

NEW YORK, December 27, 1944.

Nitrogen

This material has not been removed from allocation as had been expected, but new allocations have been made to fertilizer manufacturers for delivery during January or January/February/March of one-twelfth of the original allocations. This new allocation has been made subject to material being available. Material has been moving steadily against previous allocations and this new allocation should take care of any possible surpluses that may have been built up.

Delivery of nitrate of soda has continued steadily under allocation so that there is no change in the supply situation.

Superphosphate

This material continues tight although production during the last month was increased somewhat over November of last year. However, there is no expectancy but that there will be a shortage of this material throughout the present fertilizer year. The same tight situation prevails in triple superphosphate.

Potash

Production has continued steadily and deliveries are being made fairly well in line with allocations. Allocation of potash has continued, but in most cases supplies shouldbe ample in this country.

Phosphate Rock

Ample supplies are available and deliveries have continued steadily in spite of manpower shortage, and there is no indication that there will not be sufficient rock available for all manufacturers of superphosphate during the current season.

Sulphur

This material is also being produced in ample quantities and deliveries are being made regularly with no indication of any scarcity.

CHICAGO

Fertilizer Organics Still Scarce with Demand Good. Feed Material Market Shows Improvement.

Exclusive Correspondence to "The American Fertilizer"

CHICAGO, December 26, 1944.

A good buying demand is still noted in the organic market, but continued scarcity of material causes light trading. Any supplies offered are quickly taken at full ceiling prices.

A somewhat improved market prevails in the feed market. Demand for dry rendered tankage is better, while wet rendered is moving at slightly lower than ceiling. Blood is scarce, and the large producers of it are buyers at this time.

Ceiling prices are:

High grade ground fertilizer tankage, $3.85 to $4.00 ($4.68 to $4.86 per unit N) and 10 cents; standard grades crushed feeding tankage, $5.53 per unit ammonia ($6.72 per unit N); blood, $5.53 ($6.72 per unit N); dry rendered tankage, $1.25 per unit of protein, f. o. b. producing points.


WINTER COMES TO NORTHERN STATES
FERTILIZER
Thousands of farms, millions of Victory Gardens are covered with snow . . . resting until another tremendous production season gets under way. In 1945, as in 44 and 43, on the shoulders of the American farmer and gardener will fall the task of producing a mammoth food supply. They will need more fertilizer than ever before . . . and they'll want it packed and shipped in strong, dependable shipping sacks.
Give your fertilizer Raymond Multi-Wall Paper Shipping Sack protection! These quality Shipping Sacks are sift-proof! Dust-proof! Water-resistant! They are CUSTOM BUILT to fertilizer requirements.
THE RAYMOND BAG COMPANY
Middletown, Ohio

Post-War Plant Efficiency

By C. A. Whittle

The United States leads the world in mechanized production. How long it can maintain or increase that lead will determine our success in meeting post-war competition.

Because of mechanized efficiency, the United States has been able to pay labor the highest wages in the world, and it will maintain or advance its standard of wages only by its ability to cut production costs through the use of machinery.

The possibilities of hand labor have long since been exploited to the limit. Enhancement of the value of labor now depends upon the use of the machine. The fact is, the future hopes for a bright, new world are founded on confidence that the genius of mankind will invent new and better ways of producing things we need.

The successful manufacturer of the future will be alert to discover and apply every device that will add to operating efficiency. In fact, obsolescence is likely to be more fatal to industry in the future than ever before.

Bringing this discussion down to the fertilizer industry, what are the possibilities of cutting costs through mechanized equipment? Plant food compounders have been learning the hard way during this period of labor shortage, learning that if they had depended more on machinery and less on labor, they could have gone a long way further. A conveyor, for instance, could have taken the place of men who went away to war or to war plants. What a costly jam could have been avoided if, when materials were arriving at an already crowded plant, there had been mechanical conveyors for handling the material with a simple flipping of a switch.

Speaking of storage, an engineer drew for the writer an outline of the low-roofed storage house widely in use, in which the conveyor carried materials to the roof and dropped them in a pile below. Labor is required to constantly "trim" or spread the pile. Then the engineer sketched a higher roof on the building in which the conveyor dropped from a higher elevation the materials and naturally built up a pile that required no trimming, thus saving labor cost.

Shifting to another piece of blank paper, the engineer hastily sketched an automatic feeder operating in the bottom of a bin. By this means, he showed how a steady, accurate and even flow of materials can be maintained, whereas hand labor at its best could not do as well.

Obsolescence, it was pointed out, does not coordinate with the operating life of machinery. When something new and better will cut costs even more, the old machine, though comparatively new and good for several more years, is no longer a bargain at any price. The man who rips out the old and puts in the new cost-cutting machines will have the upper hand as against his competitor who does not follow suit.

Only one conclusion could be reached from this interview: progress in manufacturing is dependent upon keeping alert and making use of every means that contributes to production efficiency.

Many fertilizer plants have been under heavy production strain during the war and not a few are obsolete from old age, wear and tear. General overhauling is in prospect. But before plans are completed, would it not be well to consult those whose business it is to design and produce cost-cutting machinery?

Cutting costs is as important to the owner of a small mixing plant as to the owner of a large fertilizer factory. But neither should overlook the possibilities of redesigning the plant so that materials and manufactured goods may be handled with a minimum amount

of machinery. Each plant has its own problems and it may be advisable to let engineers know or have them look over the situation, not only for the manufacturer to get what is needed but to get the latest and most efficient appliances for cutting costs.

American Cyanamid Adopts Retirement Plan

American Cyanamid Company has announced the adoption of an Employees' Retirement Plan for United States employees of American Cyanamid Company, American Cyanamid and Chemical Corporation, Chemical Construction Corporation, Davis and Geck, Inc., and Lederle Laboratories, Inc. These Companies are contributing all of the funds for the cost of the Plan, which are to be administered by Guaranty Trust Company of New York under a Trust Agreement.

The Plan is to be effective as of January 1, 1944, and all United States employees of the above-mentioned Companies will be eligible on reaching age 35 and completing two years of service. Normal Retirement Date will be age 65, except that the Normal Retirement Date of those who had passed their 60th birthday on January 1, 1944, will be January 1, 1949. The Plan permits any employee to retire on a reduced pension after reaching age 55 and having had at least ten years of continuous service.

An unusual feature of the Plan provides that former employees who have served in the United States Armed Forces since June, 30, 1940, and return to one of the above-mentioned Companies promptly after their release are credited under the Plan with up to a maximum of five years of their war service, as though they had been employed during such period.

Retirement annuities will be credited for past services prior to January 1, 1944 (back to age 35 and completion of two years service), and future service after January 1, 1944, at the following rates:

Past Service—1 per cent of the employee's annual earnings rate at December 31, 1943, which is over \$600 but not over \$3000, plus 1¼ per cent of the excess, multiplied by the number of years of credited past service.

Future Service—1¼ per cent of the employee's annual earnings, which is over \$600 but not over \$3000, plus 1½ per cent of the excess for each year while the employee is a member of the Plan.

The Plan limits the pension payable to any employee to a maximum of \$12,000 a year.

Fertilizers For Liberated Europe

Among the objectives of new lend-lease appropriations, fertilizer shipments to liberated areas of Europe are mentioned. It is to be hoped that those who decide what shall be exported for relief in Europe are fully advised that in some important particulars this country is short of fertilizer materials and is in no position to assist our allies in these particulars.

Our supplies of agricultural nitrogen and phosphates are of greatest concern. A large part of our triple phosphates have been sent via lend-lease to Europe. This began before superphosphate production had encountered the present serious sulphuric acid shortage that is threatening a reduction of the output of superphosphate below that of last year. This, too, in the face of an increased demand.

The exportation of raw rock phosphate is more nearly within the range of possibilities than the shipment of the manufactured phosphate products.

To keep you supplied with Bags

WE'RE NOT OVERLOOKING A SINGLE BET

THERE are many angles to the job of keeping the fertilizer industry supplied with bags in these days of shortages. But we're working on all of them! Here's an example:

A shortage of the necessary cotton cloth is, of course, a bottleneck. So, to supplement our usual close cooperation with the cotton industry, we took an unusual step —

An advertisement, appearing in the leading cotton textile newspaper, told the cotton merchants (1) *about the amazing growth of the essential fertilizer industry,* (2) *the need for bags for fertilizer and* (3) *the types of cotton goods particularly needed.*

The whole object of this unusual undertaking is to create a closer cooperation between the cotton textile and the bag industries . . . *to give you greater assurance of the supply of bags you need.*

BEMIS BRO. BAG CO.

Baltimore • Boston • Brooklyn • Buffalo • Charlotte Chicago • Denver • Detroit • East Pepperell • Houston Indianapolis • Kansas City • Los Angeles • Louisville Memphis • Minneapolis • Mobile • New Orleans • New York City • Norfolk • Oklahoma City • Omaha • Peoria St. Helens, Ore. • St. Louis • Salina • Salt Lake City San Francisco • Seattle • Wichita • Wilmington, Calif.

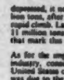
No. 10 . . of a Series

An Open Letter
to the Cotton Textile Industry:

☆ ☆ ☆

One of the largest and fastest-growing uses for bags is shipping commercial fertilizer. The cotton constructions used in making these bags are principally 36" 2.95 yd and 40" 2.11 yd. Osnaburg.

A quick review of the growth of the business and the trend in its use of bags may be interesting.



In the 1920's, the annual consumption of commercial fertilizer in the United States ranged from 6 to 8 million tons. In 1932, when farm prices were depressed, it nose-dived to about 4 million tons, after which it started a rather rapid climb. Last year the total was over 11 million tons. It will probably exceed that mark this year.

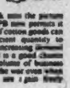
As for the importance of the fertilizer industry, consider this point: 20% of United States crop production last year was due to the use of fertilizer. Putting it another way—without the help of fertilizer, cultivation of an additional 50 million acres would have been necessary in order to produce the same volume of farm crops. And 50 million acres is nearly one and one-half times the area of the State of Iowa.

Now for a little bag history. Up to about 1934, fertilizer was packed principally in burlap. Cotton accounted for only about 15% and paper about 1%.

In the intervening years, burlap held fairly steady in the actual number of bags used, although it declined percentagewise because total fertilizer production had gone up. Another factor—during part of 1942 and all of 1943, the use of burlap bags for fertilizer was prohibited by the WPB.

Since 1934, cotton bags definitely have gained in preference. In 1943 more than three times as many were used as in 1942, accounting for about 25% of the total.

Here's an interesting observation from the cotton viewpoint. Last year, the first full year when burlap was not permitted to be used for fertilizer, a choice between cotton and paper bags had to be made to replace the prohibited burlap. Since deliveries of cotton bags increased over the previous year much more than those of paper, the preference must have been for cotton.



Burlap is coming back into the picture to some extent as WPB now permits it to be used. However, if cotton goods can be provided in sufficient quantity to meet the continually increasing demand for cotton bags, there is a good chance that this important volume of business can be retained after the war even when other types of bags are again freely available.

Bemis Bro. Bag Co.

This is a greatly reduced reproduction of the advertisement to the cotton textile industry, telling how cotton goods are required for bags for fertilizer. Copy will be sent you on request.

East Pepperell, Mass.

After all, North African phosphates, on which Europe largely depended prior to the war, have been available to the allies for more than a year and are doubtless in position to serve again. Then, too, basic slag, more commonly known in Europe as Thomas slag, is an important phosphatic fertilizer now doubtless in maximum production as a by-product of England's steel mills.

In view of these considerations, is there good reason for continuing the shipment of phosphatic fertilizers, much less for increasing them, when there is not enough for our own needs?

Lend-leasing nitrogenous fertilizers to Europe is perhaps fraught with greater danger to American agriculture than the exportation of manufactured phosphates. Nitrogen is an essential of ammunition. The increasing tempo of guns blasting German fortifications from ground batteries and with bombs from air batteries, is diverting nitrogen, an essential plant food element, away from agricultural use to an alarming extent.

Organic nitrogen has been largely diverted to the feed trade and offers no relief. Nor will the scheduled imports of Chilean nitrate, nor the domestic production of nitrate of soda, or sulphate of ammonia, satisfy the demand of agriculture in this country for 1945.

Of course, we have no nitrogen to spare, however badly it may be needed in Europe or however much we might like to help. Perhaps the quickest solution to the European agricultural nitrogen problem will come with the capture of some of Germany's synthetic nitrogen plants.

Domestic potash production is more nearly measuring up to national requirements than the home production of any of the three elements of fertilizer. But French Alsatian potash mines along with Palestine, Spanish and Russian supplies, promise a measure of relief to European agriculture.

GREENHOUSE AND FIELD TESTS ON PHOSPHATES

(Continued from page 10)

Blaser and Ritchey (*6*) found that phosphate rock and colloidal phosphate were not satisfactory sources of phosphorus for alyceclover on Norfolk sandy loam in Florida.

Barht and Hughes (*1*) found that an application of colloidal phosphate at the rate of 12 pounds per tree annually for 4 years had very little effect in controlling bronzing of citrus trees in Florida and did not increase the yield of fruit over that obtained from the control trees.

The Georgia Coastal Plain Experiment Station (*15*) compared various sources of phosphoric acid, including soft phosphate (presumably colloidal phosphate), for sweet potato production and reported that during the 4 years over which the test was run ammoniated superphosphate produced the highest average yield of marketable potatoes; soft phosphate produced the lowest average yield.

Brown *et al.* (*11*) conducted comparisons of colloidal phosphate and ordinary superphosphate as sources of phosphorus in potato fertilizers in Maine, New Jersey, Pennsylvania, and Virginia, as a result of which they stated:

"The results reported herein afford a pattern showing (1) that the use of colloidal phosphate as a source of phosphorus in potato fertilizer is not justifiable, and (2) that the maintenance of normal vine growth and maximum potato yields requires the use of a material high in available phosphorus as the source of phosphorus in potato fertilizers."

Experimental Work. Greenhouse Investigations

The greenhouse pot-culture tests were conducted in pots holding about 11 pounds of soil. The indicator plants grown were millet (German, Hungarian, and Japanese), corn,

soybeans, wheat, and Swiss chard. The fertilizer was made up on a 5–12–6 basis. Nitrogen was derived from sodium nitrate and ammonium sulphate, each material furnishing 50 per cent of the total nitrogen applied. The potash was derived from high-grade muriate and, as an insurance against magnesium deficiency, calcined kieserite was incorporated with the fertilizer at the rate of 30 pounds magnesium oxide (MgO) per ton of fertilizer. The rate of fertilizer application was 2,000 lb. per acre in all greenhouse tests. The phosphorus was derived respectively from colloidal phosphate, Tennessee brown-rock phosphate, and superphosphate, on the basis of total P_2O_5.[5] A no-phosphorus (5–0–6) control mixture was used as well. All fertilizer applications were mixed throughout the soil

TABLE I

GREENHOUSE POT-CULTURE RESULTS OBTAINED IN COMPARISONS OF COLLOIDAL PHOSPHATE, TENNESSEE BROWN-ROCK PHOSPHATE, AND SUPERPHOSPHATE AS SOURCES OF PHOSPHORUS FOR VARIOUS CROP PLANTS

A. Results with German millet on Norfolk loamy fine sand; pH 5.5:

Dry Weight of Crop and Relative Standing[6]

Sources of P_2O_5 5–12–6 Fertilizer	Test No. 1[7] Gms.	Test No. 2[7] Gms.	Test No. 3[7] Gms.	Test No. 4[7] Gms.	Test No. 5[7] Gms.	Test No. 6 Gms.	Test No. 7[8] Gms.	Total All Tests: Actual Gms.	Total All Tests: Relative
N-K (5–0–6)	4.8	5.8	5.5	6.9	1.7	11.4	40.3	75.9	100.0
Superphosphate	18.5	13.4	20.2	19.8	7.7	33.8	81.4	194.8	257.0
Colloidal phosphate	8.6	6.9	11.3	7.7	4.4	12.2	49.2	100.3	131.0
Tenn. brown-rock phosphate	8.5	6.8	10.5	8.0	4.6	11.8	50.4	100.6	131.2

B. Results with Hungarian and Japanese millet on Norfolk loamy fine sand; pH 5.5:

Dry Weight and Relative Standing[6]

Sources of P_2O_5 in 5–12–6 Fertilizer	Hungarian Millet					Japanese Millet			
	Test 1 Gms.	Test 2 Gms.	Test 3 Gms.	Total Gms.	Relative	Test 1 Gms.	Test 2 Gms.	Total Gms.	Relative
N-K (5–0–6)	45.4	8.9	49.4	103.7	100.0	71.3	28.1	99.4	100.0
Superphosphate	52.4	17.2	52.4	122.0	118.6	109.1	39.6	148.7	150.0
Colloidal phosphate	45.5	10.8	34.5	90.8	87.6	74.3	30.4	104.7	105.3
Tenn. brown-rock phosphate	47.2	11.2	33.9	92.3	89.0	73.0	31.0	104.0	104.6

C. Results with corn, soybeans, and wheat on Norfolk loamy fine sand; pH 5.5:

Dry Weight of Crop and Relative Standing[6]

Source of P_2O_5 in 5–12–6 Fertilizer	Corn		Soybeans		Wheat	
	Gms.	Relative	Gms.	Relative	Gms.	Relative
N-K (5–0–6)	15.8	100.0	12.8	100.0	19.3	100.0
Superphosphate	22.9	145.0	42.2	330.0	31.9	165.3
Colloidal phosphate	19.1	121.0	29.8	232.0	23.7	123.0
Tenn. brown-rock phosphate	20.0	126.0	28.7	224.3	23.5	121.7

D. Results with German millet on four soils:

Dry Weight Yields of Millet on:[6]

Source of P_2O_5 in 5–12–6 Fertilizer	Caribou Loam; pH 4.6		Chester Loam; pH 6.5		Norfolk Loamy Fine Sand; pH 5.5		Sassafras Sandy Loam; pH 5.6	
	Gms.	Relative	Gms.	Relative	Gms.	Relative	Gms.	Relative
N-K (5–0–6)	54.8	100.0	32.0	100.0	31.3	100.0	54.7	100.0
Superphosphate	72.6	132.0	50.2	157.0	55.4	177.0	63.5	116.0
Colloidal phosphate	60.8	111.0	40.5	126.4	31.0	99.0	56.0	102.4
Tenn. brown-rock phosphate	60.6	110.6	41.4	129.1	30.8	98.4	56.2	102.7

[5]The colloidal phosphate used in most of the greenhouse tests contained 23.54 per cent total P_2O_5. The Tennessee brown-rock phosphate contained 34.26 per cent total P_2O_5. The superphosphate had a total content of 19.2 per cent P_2O_5 practically all of which was available. The colloidal phosphate passed a 5-mesh sieve and was composed of soft claylike particles which disintegrated on contact with water. At least 85 per cent of the Tennessee brown-rock phosphate passed through a 200-mesh sieve.

[6]Three pots for each treatment with 10 plants per pot; except in the case of corn, 2 pots, 5 plants each.

[7]Harvested at early stage of growth.

[8]See Fig. 1.

How STORAGE TANKS can help Fertilizer Manufacturers

STORAGE TANKS for Urea-Ammonia Liquor, when installed on your premises, can be a real help in insuring flexibility of manufacturing operations, for they make it possible to have a supply of ammoniating liquor on hand at all times. In addition, such an installation enables you to unload tank cars promptly, releasing this critically needed equipment promptly for further service.

Our service representatives are available for consultation. For information and blueprints of storage tanks, write to: E. I. du Pont de Nemours & Co. (Inc.), Ammonia Department, Wilmington 98, Delaware.

KEEP ON BUYING WAR BONDS

DU PONT UREA-AMMONIA LIQUORS

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DU PONT

BETTER THINGS FOR BETTER LIVING ... THROUGH CHEMISTRY

*REG. U. S. PAT. OFF.

by means of a mechanical mixer. The results of one series of greenhouse pot-culture studies are given in Table 1.

An examination of the results presented in Table I, sections A to D, shows that:

(1) In section A the results of the tests with German millet definitely show superphosphate to have been superior to colloidal phosphate or Tennessee brown-rock phosphate (Fig. 1). On the basis of average results for all tests, yield with superphosphate was 2.6 times that of the no-phosphorus control, whereas the yields with colloidal phosphate and phosphate rock were only 1.3 times that of the control.

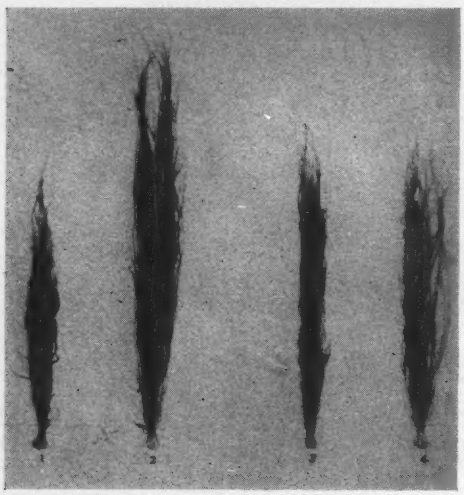

Fig. 1—Comparison of superphosphate, Tennessee brown-rock phosphate, and colloidal phosphate as sources of phosphorus for German millet
1. No phosphorus (5–0–6) 2. Superphosphate (5–12–6) 3. Tennessee brown-rock (5–12–6) 4. Colloidal phosphate (5–12–6).

(2) Results given in section B for Hungarian and Japanese millets also show that both colloidal phosphate and Tennessee brown-rock phosphate were much less effective than superphosphate.

(3) The response of corn, soybeans, and wheat was much more marked to superphosphate than to the other two phosphatic materials used (section C).

(4) The results obtained on four different soils (section D) of varying pH showed that superphosphate invariably outranked either colloidal phosphate or the rock phosphate as a source of phosphorus for German millet.

In Table II are given the results of another pot-culture study in which the two mineral phosphates and superphosphate were compared as sources of phosphorus for German, Hungarian, and Japanese millets. The tests were made on Norfolk loamy fine sand, pH 5.5, following the usual procedure employed in all the pot-culture tests reported herein, except that in the present test data are given for heads as well as stalks.

An examination of the results given in Table II shows (1) that there was a fairly marked response to available phosphorus on the part of the three millets, especially German millet; (2) that for all three the superphosphate-containing fertilizer performed more efficiently than either of the mineral phosphates, more so with respect to German millet than to either the Hungarian or Japanese millet. This finding applied to both heads and stalks.

In Table III are given the results of a pot-culture test with German and Japanese millet.

TABLE II

RESULTS WITH MILLET (GERMAN, HUNGARIAN, AND JAPANESE), COMPARING SUPERPHOSPHATE, COLLOIDAL PHOSPHATE, AND TENNESSEE BROWN-ROCK PHOSPHATE

Soil used, Norfolk loamy fine sand; pH 5.5

Yield of Millet (30 plants) Oven-dry Basis

Source of P_2O_5 in 5–12–6 Fertilizer	German				Hungarian				Japanese			
	Actual Weight			Relative*	Actual Weight			Relative[8]	Actual Weight			Relative[8]
	Stalks Gms.	Heads Gms.	Total Gms.		Stalks Gms.	Heads Gms.	Total Gms.		Stalks Gms.	Heads Gms.	Total Gms.	
N-K (5–0–6)	40.3	2.3	42.6	100.0	45.4	7.2	52.6	100.0	71.3	28.1	99.4	100.0
Superphosphate	81.4	8.7	90.1	211.0	52.4	11.9	64.3	122.2	109.1	39.6	148.7	149.6
Colloidal phosphate	49.2	4.2	53.4	125.3	45.5	8.2	53.7	102.1	74.3	30.4	114.7	115.4
Tenn. brown-rock phosphate	61.6	5.8	67.4	158.7	47.2	9.6	56.8	108.0	91.3	36.7	128.0	128.7

*Relative comparisons based on total weights.

See Page 4

The results given in Table III again show that the superphosphate-containing fertilizer produced better yields than did either of the mineral phosphates; neither of the latter gave materially better results than the no-phosphorus control treatment.

TABLE III

RESULTS WITH MILLET (GERMAN AND JAPANESE) COMPARING SUPERPHOSPHATE, COLLOIDAL PHOSPHATE, AND TENNESSEE BROWN-ROCK PHOSPHATE

Soil used, Norfolk loamy fine sand; pH 5.5

Sources of P_2O_5 in 5-12-6 Fertilizer	Oven-dry Weights (30 Plants): German Millet[a] Actual Weight Gms.	German Millet[a] Relative	Japanese Millet[a] Actual Weight Gms.	Japanese Millet[a] Relative
N-K (5-0-6)	4.1	100.0	7.4	100.0
Superphosphate	9.2	224.0	9.4	127.0
Colloidal phosphate	4.3	105.0	7.5	101.3
Tennessee brown-rock phosphate	4.4	107.0	8.0	103.0

[a]Cut at early stage of growth.

In a final pot-culture test, the results of which are given in Table IV, comparison was made with wheat and Swiss chard as the indicator crop plants.

The results with Swiss chard are the first instance in the studies herein reported in which the raw phosphates made as good a showing as did superphosphate, which indicated that in this test Swiss chard obtained its phosphorus needs from the relatively insoluble phosphates. In the case of wheat the greatest response was shown to the superphosphate-containing fertilizer mixture, which is in harmony with all other tests conducted in the greenhouse studies.

TABLE IV

YIELDS OF WHEAT AND SWISS CHARD OBTAINED IN A COMPARISON OF SUPERPHOSPHATE, COLLOIDAL PHOSPHATE, AND TENNESSEE BROWN-ROCK PHOSPHATE AS PHOSPHORUS SOURCES

Oven-dry basis; Norfolk loamy fine sand, pH 5.5

Sources of P_2O_5 in 5-12-6 Fertilizer	Wheat 25 Plants Gms.	Swiss Chard 10 Plants Gms.	Relative Wheat	Relative Chard
N-K (5-0-6)	63.0	109.7	100.0	100.0
uperphosphate[a]	127.7	135.6	202.7	123.6
Colloidal phosphate[b]	89.5	135.5	142.0	123.4
Tenn. brown-rock phosphate[c]	85.0	138.0	135.0	125.9

[a]18.3 per cent total P_2O_5.
[b]23.5 per cent total P_2O_5.
[c]33.8 per cent total P_2O_5.

Field Experiments

A study comparing colloidal phosphate, Tennessee brown-rock phosphate, and superphosphate as sources of phosphorus in potato fertilizers was conducted in Virginia in 1937 and 1938, also for sweet potato and tomato fertilizers in 1938. The results are given in Table V.

TABLE V

YIELDS OBTAINED IN A COMPARISON OF SUPERPHOSPHATE, COLLOIDAL PHOSPHATE, AND TENNESSEE BROWN-ROCK PHOSPHATE AS SOURCES OF PHOSPHORUS IN POTATO, SWEET POTATO, AND TOMATO FERTILIZERS[10]

Norfolk loamy fine sand, pH 5.5

Sources of P_2O_5 in 6-8-6 Fertilizer[11]	Yield of Crop in Bushels per Acre: Potatoes 1937 Bu.	Potatoes 1938 Bu.	Potatoes Ave. Bu.	Sweet Potatoes 1938 Bu.	Tomatoes 138 Bu.
N-K (5-0-6)	106	160	133	160	155
Superphosphate	165	249	207	221	227
Colloidal phosphate	112	174	143	190	152
Tennessee brown-rock phosphate	115	170	143	188	155
Yield increase for superphosphate over colloidal phosphate	53	75	64	31	75
Yield increase for superphosphate over Tennessee brown-rock	50	79	64	33	72

[10]Tests conducted on farm of Thos. R. Shipp, near Gunston Hall, Virginia.

[11]Rate of fertilizer application: Potatoes, 2,000 pounds per acre; sweet potatoes and tomatoes, 1,500 pounds per acre.

An examination of the results given in Table V shows clearly that superphosphate proved superior to colloidal phosphate for all crops, the latter source of phosphorus not doing much better than the no-phosphorus (6-0-6) mixture.

THE DOUGH YOU BLOW —will bring U.S. woe!

What a boom we were handed by World War No. 1! Money came easily—went easily. Everybody was splurging on everything. Prices went skying. Sugar eventually hit 28¢ a pound!

Bye-bye, boom. Factories closed; men laid off. Prices and wages sinking fast. With jobs scarce, some of that dough we'd blown would have come in mighty handy then.

Prosperity. Stocks up fifty points in a week. Again everybody was buying everything—regardless of cost. Depression? Phooey . . . We thought we'd found a way to *lick* depressions.

Or had we? Bread lines, apple venders. WPA. Prices dropping. Wages dropping. Everything dropping—except the mortgage. "What goes up must come down." Depression follows a rise.

We're splurging again. Americans have been earning more. But even today there are fewer goods to spend it on—so naturally prices rise. DON'T LET *IT* ALL HAPPEN AGAIN!

---

4 THINGS TO DO to keep prices down and help avoid another depression

1. Buy only what you really need.
2. When you buy, pay no more than the ceiling prices. Pay your ration points in full.
3. Keep your *own* prices down. Don't take advantage of war conditions to ask for more—for your labor, your services, or the goods you sell.
4. *Save.* Buy and hold all the War Bonds you can afford—to help pay for the war and insure your future. Keep up your insurance.

EVERY WAR BOND YOU BUY WILL HELP US KEEP PRICES DOWN

A United States War message prepared by the War Advertising Council; approved by the Office of War Information; and contributed by this magazine in cooperation with the Magazine Publishers of America.

Summary

Greenhouse and field experiments were conducted to determine the comparative effectiveness of colloidal phosphate, Tennessee brown-rock phosphate, and ordinary superphosphate as sources of phosphorus for various crop plants. The results are summarized as follows:

1. On Norfolk loamy fine sand certain indicator crops, including German, Hungarian, and Japanese millets, corn, soybeans, and wheat responded much better to superphosphate treatment. Swiss chard responded equally well to the three sources.

2. When German millet was grown on four widely different soils the yields were greater in every case with the superphosphate treatment.

3. Potato, sweet potato, and tomato yields in Virginia field experiments were greater when superphosphate was used.

4. While the use of less available (untreated) raw phosphates may be justified under appropriate soil conditions, especially in the growing of long-season or perennial crops, it is more likely that an available type of phosphate such as superphosphate, double superphosphate, or ammonium phosphate will provide greater yields and corresponding profits than the slowly available phosphates, particularly in the case of short-season crops.

Literature Cited

(1) Barht, G. M., and Hughes, A. E., "Soil Fertility and Experiments on Bronzing of Citrus," Proc. Florida State Hort. Soc. 50:23–28 (1937)

(2) Bartlett, J. M., "Colloidal Phosphate," Maine Agr. Expt. Sta. (Official Inspections) *Bul.* 137:63–64 (1930)

(3) Beckenbach, J. R., "A Fertility Program for Celery Production on Everglades Organic Soils," Fla. Agr. Expt. Sta. *Bul.* 333, 39 pp. (1939)

(4) Blaser, R. E., "Environmental Factors as Related to Growing Winter Pasture Plants in Florida," Proc. Assoc. Southern Agr. Workers, 41:83 (1940)

(5) Blaser, R. E., "Lespedeza Pasture for Florida," *Better Crops with Plant Food* 26 (9):6–10, 41–42 (1942)

(6) Blaser, R. E., and Ritchey, Geo. E. "Alyce Clover—a New Hay and Pasture Crop for the Southeast," Proc. Assoc. Southern Agr. Workers 42:99 (1941)

(7) Blaser, R. E., and Stokes, W. E., "Effect of Fertilizer on Growth and Composition of Carpet and Other Grasses," Fla. Agr. Expt. Sta. *Bul.* 390, 31 pp. (1943)

(8) Blaser, R. E., Volk, G. M., and Smith, F. B., "The Yield, Composition, and Nodulation of Several Clover Varieties as Affected by Sources of Calcium and Phosphorus in Combination with Other Fertilizers on Several Soils," Proc. of Soil Sci. Soc. of America 6:298–302 (1941)

(9) Bledsoe, R. P., "Cotton Fertilizers and Cultural Methods," *Ga. Expt. Sta. Bul.* 152, pp. 37 (1939)

(10) Brown, Bailey E., and Hawkins, Arthur, "A Comparison of Colloidal Phosphate, Rock Phosphate, and Superphosphate as Sources of Phosphorus for Potato Fertilizer in Aroostook County, Maine, *The Amer. Fert.*, 100 (8):[5]–7, 26 (1944)

(11) Brown, B. E., Chucka, Jos. A., Hawkins, Arthur, and Campbell, John C., "Field Comparisons of Colloidal Phosphate and Superphosphate as Sources of Phosphorus in Potato Fertilizers," *Amer. Potato Jour.* 21 (9):241–249 (1944)

(12) Chucka, Jos. A., and Lovejoy, Delmar B., *Annual Report of Maine Agricultural Experiment Station*, "Plant Breeding and Nutrition," *Bul.* 360:179 (1931)

(13) Fraps, G. S., "Availability of the Phosphoric Acid of Finely-Divided Rock Phosphate," Texas Agr. Expt. Sta. *Bul.* No. 509, 16 pp. (1935)

(14) Fraps, G. S., and Sterges, A. J., "Effect of Phosphates on Nitrifying Capacity of Soils," *Soil Sci.* 47: 115–121 (1939)

(15) Georgia Coastal Plain Experiment Station, *19th Annual Report, Bul.* 30:28–29 (1938–39)

(16) Georgia Experiment Station, "Colloidal Phosphate for Cotton, *Annual Report*, p. 41 (1938–39)

(17) Gross, E. E., "A Compilation of Experimental Data on Cotton Fertilizers Applicable to the Hill Sections of Mississippi," Miss. Agr. Expt. Sta. *Bul.* 321, 94 pp. (1938)

(18) Haskins, H. D., "Inspection of Commercial Fertilizers," Mass. Agr. Expt. Sta *Bul.* 54 (Control Series), 64 pp. (1930)

(19) Holley, K. T., "The Availability of Colloidal Phosphate," Ga. Expt. Sta., *Press Bul.* 428 (1936)

(20) Iowa Agricultural Experiment Station, "Preliminary Studies on the Value of Colloidal Phosphate," *Ann. Report*, p. 50 (1939)

(21) Jacob, K. D., Bartholomew, R. P., Brown, B. E., Pierre, W. H., Reid, F. R., and Tidmore, J. W., "Nutrient Value of the Phosphorus in Calcined Phosphate as Determined by Growth of Plants in Greenhouse Experiments," *Jour. Agr. Res.* 50:837–848 (1935)

(22) Karraker, P. E., Miller, Harold F., Bortner, C. E., and Todd, Jack R., Kentucky Agr. Expt. Sta. *Bul.* 413:59–86 (1941)

(23) McCool, M. M., "Fertilizer Value of Colloidal Phosphate," Contrib. Boyce Thompson Inst. for Plant Res., 10:257–266 (1939)

(24) McGeorge, W. T., "Factors Influencing the Availability of Native Soil Phos-hate and Phosphate Fertilizers in Arizona Soils," Ariz. Expt. Sta. Tech. *Bul.* 82: 295–331 (1939)

(25) Stallings, J. H., "Fertilizer Experiments with English Peas," *Fla. Grower* 37 (1):50 (1929)

(26) Volk, Garth, W., "Waste-Pond Phosphate Compared with Rock Phosphate and Superphosphate as a Fertilizer," *Jour. Amer. Soc. Agron.* 34:823–29 (1942)

(27) Volk, Garth W., "Availability of Rock and Other Phosphate Fertilizers as Influenced by Lime and Form of Nitrogen Fertilizer," *Jour. Amer. Soc. Agron.* 36:46–56 (1944)

(28) White-Stevens, R. H., "Effect of Different Sources of Phosphorus on the Production of Potatoes on Long Island," *Amer. Potato Jour.* 19:81–90 (1942)

(29) Wyche, R. H., "Fertilizer for Rice in Texas," Texas Agr. Expt. Sta. *Bul.* 602, 18 pp. (1941)

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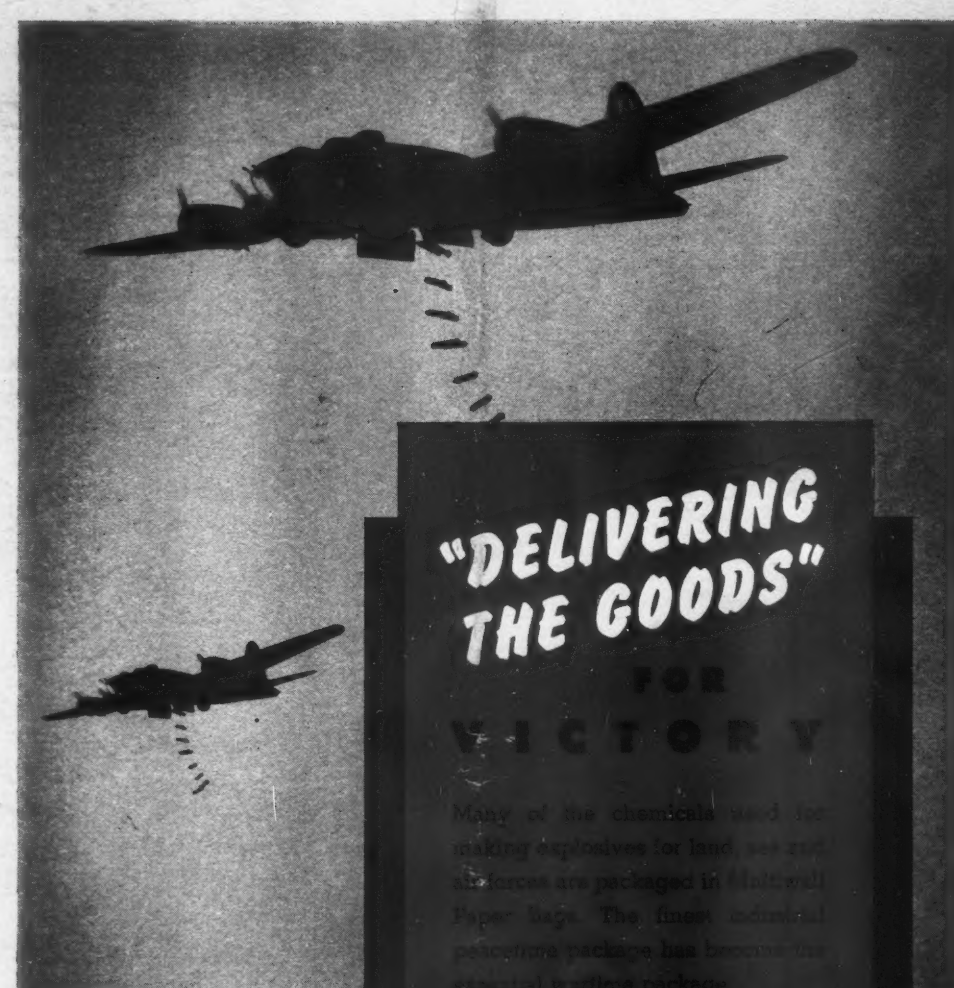

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